Indian Journal of Production and Thermal Engineering (IJPTE)
ISSN: 2582-8029(Online), Volume-1 Issue-1, December 2020

Regenerative Electric Scooter using Solar Module

H. Balaji, S. Shafeek Ali, V. Srikumar, V. Venkatesh Sairam

ABSTRACT: ***Automobile pollution is growing day by day, hence the level of pollution in cities and urban areas is at dangerous levels due to the use of vehicles. Use electric vehicles would help reduce to some degree the pollution. Electric bike normally uses a single source of power (Battery). This single source makes the conversion efficiency low and high costs as well. So that we are adding Flexible Solar module. This electric bike uses dc motor to generate power when riding, uses Photovoltaic flexible solar panels while scooter is at rest, and a port for charging the battery from main power supply. . This electric bike uses 48V 800W brushless direct current (BLDC) hub motor and Lithium ion (Li-ion) battery. Photovoltaic flexible solar panels absorb sunlight as a source of energy to generate electricity.***

Key words: regenerative braking, solar energy, battery.

I.INTRODUCTION

In India global warming is increasing day by day due to various facts. They are increased by burning the coal, plastics, fossil fuels but the major reason is IC engine operated automobiles. Nearly 10 crores of automobiles are currently running on the Indian roads, they are emitting huge number of pollutants. But according to Indian law only few grams of co2 should be emitted, but tons of co2 is emitted yearly. In order to create a global cause we are looking for an alternative, so we find electric motor operated automobiles. They are propelled by the electric motor supplied energy from the battery through the controller. They are zero pollutant, zero noise. Even though there are several drawbacks. The major one is the range of the bike and charging time of the bike. On a average a normal electric bike have a range of 70 km and charging time is 2.50 hrs. so to continue the journey after 70 kms it is required to charge the battery for 2.5 hrs. But now a days only few charging stations are there to charge the vehicle. This makes more complex about the electric bike.To answer the issue, we Introduce a technology called three-way charging system. There are totally 3 systems to charge the battery. First one is the normal charger. This will charge the battery in 2.5 hrs. This is actually a normal home use charger which will charge the battery. The second way of charging is the solar panel. This is a onboard solar panel which is fixed on the surface of the scooter which will convert the sunlight into a electrical energy.

Manuscript received on 06 November 2020 | Revised Manuscript received on 30 November 2020 | Manuscript Accepted on 15 December 2020 | Manuscript published on 30 December 2020.

***** Correspondence Author

H. Balaji, Department of Computer Science and Engineering, Institute of Postgraduate Studies - Universiti Kuala Lumpur, Institute of Postgraduate Studies - Universiti Kuala Lumpur, Malaysia

S. Shafeek Ali, Department of Computer Science and Engineering, Institute of Postgraduate Studies - Universiti Kuala Lumpur, Institute of Postgraduate Studies - Universiti Kuala Lumpur, Malaysia

V. Srikumar, Department of Computer Science and Engineering, Institute of Postgraduate Studies - Universiti Kuala Lumpur, Institute of Postgraduate Studies - Universiti Kuala Lumpur, Malaysia

V. Venkatesh Sairam, Department of Computer Science and Engineering, Institute of Postgraduate Studies - Universiti Kuala Lumpur, Institute of Postgraduate Studies - Universiti Kuala Lumpur, Malaysia

Since the solar panel is fixed in the scooter , the parking time can be used for charging. Therefore the charging time is reduced effectively.

II.OBJECTIVES

- To reduce the emission caused by the use of fossil fuel vehicles using battery powered electric vehicles.
- To reduce noise pollution from engine.
- To meet the future demand of alternate fuel vehicles due to reduced source of fossil fuels.
- To use the abundantly available free solar energy which has low maintenance cost.
- To Improve the main battery efficiency.
- To check the performances of the E-Bike in various speed conditions.
- To check the output energy in different circumstances.

III.COMPONENTS

4.1 E- Bike Components

4.1.1 Hub Motor

A hub motor is one of a class of rotary electrical machines that converts direct current electrical power into mechanical power. The most mutual types rely on the forces created by magnetic fields.

Fig 1. Hub Motor

Hub Motor Specification:

Voltage	48V
Diameter:	275mm
Motor Tire:	BLDC gearless
Tire Diameter:	10 inch
speed design:	30km/h
rated power:	800w
Rotating speed:	300-800rpm/min

4.1.2 Lithium-ion battery

Li-ion batteries use an intercalated lithium compound as the material at the positive electrode and typically graphite at the negative electrode. The batteries have a high energy density and low self-discharge.

Fig 2. Li- ion Battery

Li-ion Battery Specifications

Capacity	10 - 20Ah
Voltage	48v
Battery capacity	electric bike battery 48v 20AH
Weight	8KG
discharging current	30A
Size	85X153X420mm

4.1.3 Controller

The controller of an electric bike is an electronic circuit that controls the speed of an electric motorbus also serves as a dynamic brake. This controller unit uses power from the battery box and drives it tote motor**.**

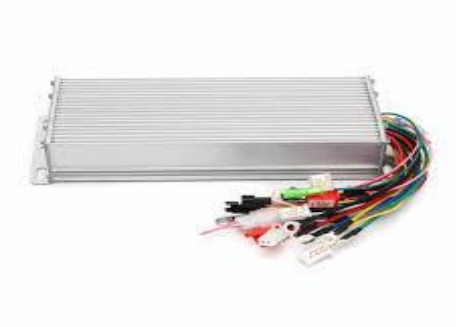

Fig 3. Controller

4.2 Solar System

4.2.1 Flexible Solar panel

It is a mono-crystalline photovoltaic panel which made of solar cells and module. It will convert the sunlight into electric energy. the produced electric energy is 12V,0.98Ah.this produced energy is boosted to 48V using DC-DC convertor so that it can charge the 48V battery .

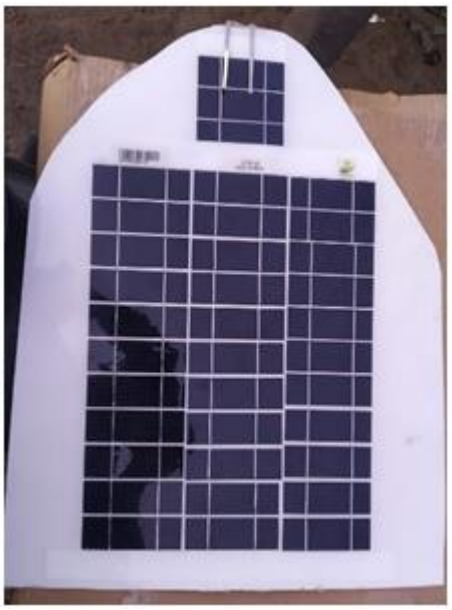

Fig 4. Flexible Solar Panel

Specification:

SOLAR MAKE	JP SOLAR SYSTEM
SOLAR MODULE TYPE	APM-P 110-2
PEAK POWER	100W
OPEN CIRCUIT VOLATGE	21.6V
SHORT CIRCUIT CURRENT	1.2Ah
Max.POWER CURRENT	1Ah
Max. POWER VOLTAGE	17.2V
DIMENSION	350X520X230
WEIGHT	0.7KG
OPERATING TEMPERATURE	-40^{O}C to 90^{O}C

4.2.2 DC-DC Convertor

A electrical device which will convert the input voltage (12V) into output voltage(48V).using transformer principle it will boost the input voltage to 48V in order to charge the battery.

Fig 5. DC-DC Converter

4.2.3 Solar Controller

Solar controller is a controller which will stabilize the input voltage from the solar panel to a constant output voltage. It has 3 pins for controlling the overall system. First pin is the input pin for solar second will be the output pin for load third pin will be the output pin for battery.

Fig 6. Solar Controller

4.2.4 Battery Indicator

It shows the battery percentage in numerical form used in solar system.

Fig 7. Battery Indicator

IV.WORKING

Solar system:

Solar panels are photovoltaic cells which will convert solar rays into electricity. Here12V DC flexible solar panel is used to convert the incoming sunlight into electricity. This flexible solar panel is fixed on the surface of the electric scooter. This is due to fact that fixing he solar panel on the surface will decrease the design complexity and reduce the air drag(resistance).the produced voltage is stabilized through the solar charge controller and it is boosted to 48V using DC-DC convertor to charge the battery. This process typically charges the battery that further increases the range and reduces the charging time.

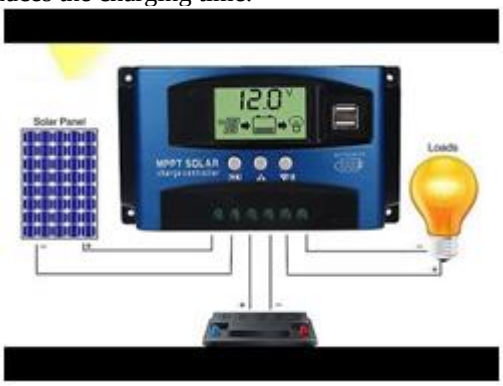

Fig 8. Solar Charge Controller

Figure 12. indicates the overall working principle. The output of the solar lines will be given to the first two pins, then the next two pins will be connected to battery, again the next two pins will be connected to the load. This controller will control the output of solar and charging of the battery.

Combined:

Overall the solar panel will convert sunlight into electric energy, that will be converted and stored in battery through solar controller. Simultaneously while braking the coupled dynamo will generate the electric energy also this will be stored in the battery on combined the electric efficiency will improve by 30%.

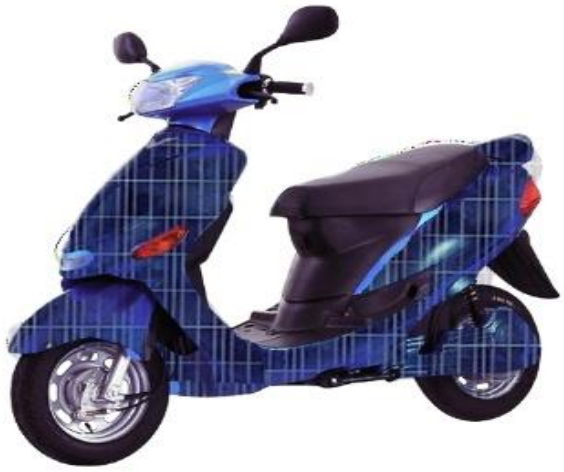

Fig 14. E-Bike

V.OUTPUT

CONDITION: vehicle have been running continuously while solar charging the bike.

Solar panel:

Table 1. solar panel output data

Test No	Produced Voltage (Avg)	Time Exposed	Prod-Uced Power (W)	Reduced Charging Time
1	13.2	1 HRS	40W	5MIN
2	12.1	2.5HRS	100W	9MIN
3	11.8	5 HRS	200W	18MIN

Table 2. Solar Charging Data

CHARGING TECHNIQUE	BATTERY CAPACITY	CHARGING TIME
NORMAL E - CHARGER	1000W	90MIN
CHARGER + (1HR OF SOLAR)	1000W	85.5MIN
CHARGER + (2.5HR OF SOLAR)	1000W	81
CHARGER + (5HR OF SOLAR)	1000W	72

VI.CONCLUSION

Finally, we concluded withoverall the solar panel will convert sunlight into electric energy, that will be converted and stored in battery through solar controller. Simultaneously while braking the coupled dynamo will generate the electric energy also this will be stored in the battery on combined the electric efficiency will improve by 30%.

REFERENCES

1. Rupesh H. Patil1, Mrunalini E. Raut2, Harshada R. Zunjarrao3, Ashish B. Padwal4, “DESIGN, ANALYSIS AND FABRICATION OF E-BIKE”, Volume: 06 Issue: 02 | Feb 2019.
2. SunikshitaKatoch, Rahul, Ranjit Kumar Bindal , “Design and Implementation of Smart Electric Bike Eco-Friendly”, ISSN: 2278-3075, Volume-8, Issue- 6S4, April 2019
3. H. S. Upare, P. S. Pandure,Design and “Experimental Study of Solar Hybrid Bicycle: A Review”, e-ISSN: 2278-1684,p-ISSN: 2320-334X PP. 44-48.
4. 1GHANSHAM. D. GAWALI, 2M. K. CHAUDHARI “DESIGN AND TESTING OF ELECTRIC BIKE”, Volume-6, Issue-10, Oct.-2018.
5. Guoqing Xu 1,2, Weimin Li 3,*, Kun Xu 3 and Zhibin Song 3 “An Intelligent Regenerative Braking Strategy for Electric Vehicles”, Energies 2011, 4, 1461-1477; doi:10.3390/en4091461.
6. Jocelyn Diosanto1, Jazelle Mediavillo1, Krizzle Pereda1, Pamela Sacdalan1, Engr.Noriel Mallari1,*, and Engr. Isidro Marfori1 “Regenerative Braking for Pedal-Assist Electric Bicycle (Pedelec)”.
7. P. Suresh Kumar, Swapnil Joshi, N. Prasanthi Kumari, Sathyajit Nair, Suman Chatterjee “Modification of Existing Regenerative Braking System for Electric Vehicle”, ISSN: 2278-3075, Volume-8 Issue-11, September 2019.
8. Rohit Somnath Sonawane1, Sagar Kailas Khairnar2, Shivam Ahir3, Bhimrao Dabhade4 "ELECTRIC BICYCLE USING TREADMILL", Volume: 06 Issue: 04 | Apr 2019.
9. KUMARESAN.N1, BHARATHKUMAR.M2,PRAVEEN.M3 , RAMACHANDRAN.S4 “FABRICATION OF E-BIKE WITH REGENERATIVE BRAKING SYSTEM”, Volume: 06 Issue: 03 | Mar 2019
10. Mayur Parmar, Rushi Trivedi, Santosh Nair ,Vikit Vora Guided by: Prof. Martand Jha “Solar Powered E-Bike”, Vol-2, Issue-5, 2016 ISSN: 2454-1362.